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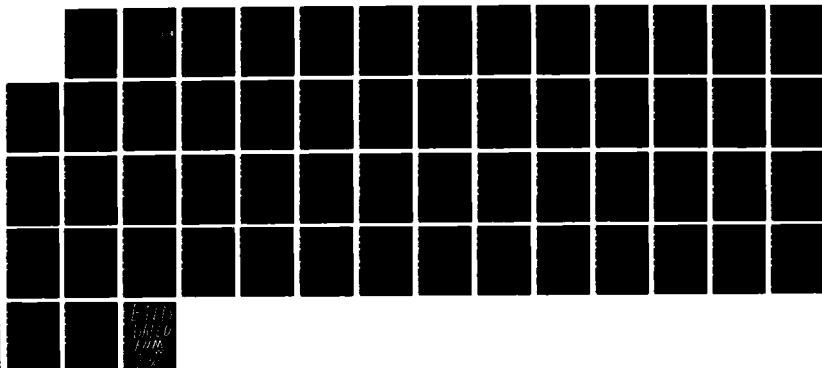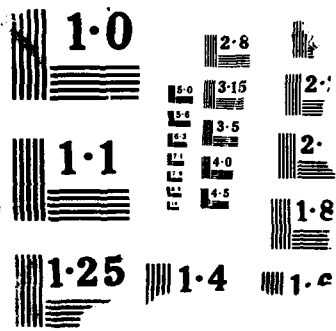   LEAVENWORTH KS SCHOOL OF ADVANCED MILITARY STUDIES
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MERCURY'S DILEMMA:
C3I AND THE OPERATIONAL LEVEL OF WAR

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School of Advanced Military Studies
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Fort Leavenworth, Kansas

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In 1982, the US Army began its renaissance of the operational level of war with the publication of a revised Field Manual (FM) 100-5, Operations. The rediscovery of this level and the subsequent experimentation with it strained the very limits of the Army's command, control, communications and intelligence (C3I) systems. Virtually all branches of the Army felt the changes brought on by FM 100-5, especially in the areas of firepower, mobility, and protection. Commanders had to view military operations from a broader perspective and act accordingly. The significant impact of the operational level of war has been in organizational changes, new concepts, and dynamic operations. The effect of these changes on C3I are reviewed and assessed in this monograph. The first topic reviewed is the Army's concept of operational level warfare. Next, the theoretical and doctrinal bases of the Army's C3I systems are examined. Finally, the requirements for C3I at the operational level are presented and conclusions drawn. ⬈
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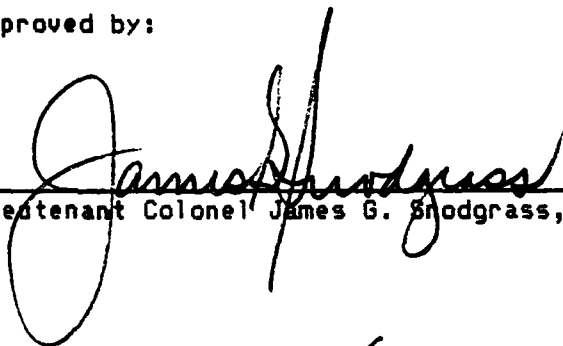U.S. Army Command and General Staff College
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ABSTRACT

MERCURY'S DILEMMA: C3I AND THE OPERATIONAL LEVEL OF WAR by Major Paul D. Hughes, USA, 49 pages.

In 1982, the US Army began its renaissance of the operational level of war with the publication of a revised Field Manual (FM) 100-5, Operations. The rediscovery of this level and the subsequent experimentation with it strained the very limits of the Army's command, control, communications and intelligence (C3I) systems. Virtually all branches in the Army felt the changes brought on by FM 100-5, especially in the areas of firepower, mobility, and protection. Commanders had to view military operations from a broader perspective and act accordingly. The significant impact of the operational level of war has been in organizational changes, new concepts, and dynamic operations. The effect of these changes on C3I are reviewed and assessed in this monograph. The first topic reviewed is the Army's concept of operational level warfare. Next, the theoretical and doctrinal bases of the Army's C3I systems are examined. Finally, the requirements for C3I at the operational level are presented and conclusions drawn.

The conclusions are divided into four separate categories, one for each element of C3I. Among the several findings of this research, it is the view that the Army's C3I doctrine fails to address the needs of all four elements equally. There is a decided bias towards technological solutions to problems that do not respond to such corrective measures. This bias has favored the communications element over the other three and has resulted in Army commanders being provided with one of the best tactical communications systems in the world. However, such systems cannot redress faulty command styles, disjointed control measures, or inadequate intelligence. All four elements must work in concert with one another for the operational commander to plan and conduct effective campaigns.

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Mercury's Dilemma:

C3I and the Operational Level of War

The commanders and their staff officers quietly departed the barn as the
corps G3 gathered his materials together. The officers had just attended the
corps commander's briefing on the upcoming attack. The Commander, NORTHAG, had
assigned the US corps the mission of penetrating the Soviet defenses and seizing
a major city that sat astride the Soviet lines of communication. The corps
commander was uneasy, however, because none of his subordinate commanders had
questioned him about any aspect of the operation. Had he really planned a
superb operation? Had his staff adequately developed the necessary branches and
sequels to the plan? The corps signal officer had reported that communications
were in the best shape yet since the war began 13 days ago. No logistical
problems were reported by the G4 and both the G2 and G3 were confident that the
enemy would be caught completely by surprise. Then why was the corps commander
uneasy? What was it that made his stomach tense, his guts burn, his palms
sweat?

His concerns were many, as could naturally be expected for a man who had
just condemned many soldiers to their deaths. But in his quest to minimize
those necessary losses he questioned himself about whether the multinational
planning staff at NORTHAG really knew how his corps executed AirLand Battle
doctrine in combat, whether effective communications was all that was necessary
for command and control, and whether his support command could keep pace with
the attack. Was the latest intelligence from NORTHAG timely and accurate?
Would the SEAD operation be successful and would his air support be on time?
Most importantly, did his subordinate commanders really comprehend his
intentions? In the back of his mind the corps commander questioned if his

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command, control, communications and intelligence (C3I) system was adequate for the challenges that lay ahead.

Although the above vignette is hypothetical, it highlights concerns that have been expressed by many officers throughout the Army's various levels of command. Current literature leads one to believe, however, that effective C3I is dependent upon improved state of the art communications systems.

In a recent publication one writer went so far as to claim that the Army's newest family of tactical communications means, Mobile Subscriber Equipment (MSE), "...promises dramatic improvement to all aspects of C2 (command and control)."[1] This widely held assertion is fraught with danger because it assumes that rapid, effective communications affords the commander improved C2 through its capabilities of linking him with anyone on the battlefield. As desirable as such communications systems are, the fact remains that the human mind can process information only at reduced speeds relative to the communications systems. Therefore, if the system only passes inaccurate or faulty orders and reports hastily developed by poorly organized and trained staffs operating under the stress of combat, communications capabilities between command elements is moot. Additionally, MSE remains terrain dependent and inadequately protected from the effects of small arms, artillery, and chemical attacks. Consequently, a C3I system more dependent upon communications than its organization and doctrine is likely to fail in an offensive operation requiring penetrations deeper than 20 kilometers.

Proponents of automated C3I systems contend that such systems provide commanders with tremendous amounts of intelligence that help the commander select the correct course of action, neglecting the fact that the commander's superior analytical capabilities are the ultimate decisionmaking tools.[2] Another critic suggests that too much intelligence, especially if provided by

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higher level sources, can paralyze the decisionmaking process and "spook" the

commander into baseless actions.(3)

The central issue of this paper is that the introduction of the operational

level of war, compounded by the advances in firepower, mobility, and protection,

has strained the limits of the US Army's concept of C3I. This paper's purpose

is to examine the theory and doctrine of C3I as it relates to the operational

level of war. Three research questions help to focus this examination: 1) What

characterizes the US Army's concept of the operational level of war? 2) What are

the theoretical and doctrinal bases of the US Army's C3I systems? and 3) What

are the C3I requirements of the operational level of war?

This study is significant because the operational level of war has placed

new demands on the Army in terms of organizations, concepts, and operations.

Prior to the renaissance of this level, C3I was viewed from the perspective of

either strategic or tactical levels and was resourced as such. The differing

demands of the strategic and tactical levels created C3I systems that were just

as different. The melding of these two differing types of systems may not be

suitable for the operational level of war and could result in the failure to

achieve operational goals. Only through the examination of command, control,

communications and intelligence requirements with respect to the allotted

organizations, processes and facilities will the Army be able to develop an

effective C3I system for its operational level of war.

The Operational Level of War

It is not possible to discuss the operational level of war without placing

it in its correct context with strategy. Military strategy is defined as

"...the art and science of employing the armed forces of a nation or alliance to

secure policy objectives by the application or threat of force."(4) The great

theorist, Carl von Clausewitz, defined strategy as "...the use of the engagement

for the purpose of war."(5) The obvious difference between the two is the idea of the threat to use force. Whereas Clausewitz saw the height of effective strategy to be the battle in which the enemy force is destroyed, AirLand Battle allows for the threat of destruction of the enemy to be an acceptable means of attaining the end-state.

Hans Delbruck, the late-19th century German military historian, concluded that all military strategy could be divided into two basic forms. The first form of strategy, which is the form Clausewitz addressed in On War, is the strategy of annihilation (Niederwerfungsstrategie). The only aim of this strategy is to bring the enemy to the decisive battle and annihilate him. The general's challenge was to construct the appropriate scenario for battle.

The second strategy, that of exhaustion (Ermattungsstrategie), sought to defeat the enemy through a combination of battle and maneuver. One side sought favorable terms for battle through the use of maneuver. Battle was seen as merely another form of defeating the enemy and was considered no more important than a blockade, the reinforcement of an area, or the denial of an economic resource to the enemy.(6) According to Delbruck, the commander had a variety of options from which to choose after he carefully considered "...all circumstances -- the aim of the war, the combat forces, the political repercussions, the individuality of the enemy commander, and of the government and people of the enemy, as well as his own...".(7) He could devise his campaign based on battle and maneuver or revert to the classical Clausewitzian style of seeking the decisive battle.

Several assumptions are inherent in both of Delbruck's forms of strategy. The practitioner of the strategy of annihilation seeks to bring overwhelming combat power to bear against the enemy at a decisive point and time. The campaigns of Napoleon are examples of this style of campaigning. Although

outnumbered on many occasions, the Emperor usually was successful in placing his

forces astride the enemy's lines of communications or in splitting coalition

forces and defeating them in detail. Napoleon correctly assumed that his forces

were better structured to permit their rapid movement to points of decisive

combat -- the decisive battle. His force structure permitted the concentrating

of large forces against a point on the battlefield where the enemy was at a

numerical disadvantage either in troops or field pieces. When allowed to pick

the site of battle, Napoleon used the terrain to his fullest advantage. In the

final analysis, Napoleon always believed himself capable of achieving some form

of superiority, either in numbers or position, that would allow him to defeat

his enemy decisively and end not only the campaign, but also the war.

As military strategy evolved into the 20th century it underwent significant

changes caused by the Industrial Revolution and changing political philosophies.

One of the eminent theorists of the century, the Russian, Mikhail Tukhachevskiy,

commented on the outdated Napoleonic strategy:

> ...unimpeded movement of a large force (as required by
> the Napoleonic school of thought) proved impossible. In
> their movements, armies engaged in one general encounter
> after another, and a decisive annihilating conflict did not
> come about until the final engagement. In other words,
> because actions were not resolved in full measure it was
> impossible to bring a destructive operation to a conclusion,
> and inversely a (campaign) could not create a situation
> leading to a general annihilating battle.(8)

Delbruck's second style of strategy, that of exhaustion, offers the

alternative to the unfulfilling annihilation strategy. Precisely when an armed

force cannot gain the superiority in combat power to overwhelm its enemy, it

must seek to defeat the enemy through a variety of other measures. In modern

context, the US Army may not be able to bring an overwhelming amount of combat

power to bear against an enemy in a given theater of operations. This inability

may be caused by any number of factors, such as political constraints,

time/space difficulties, lack of adequate manpower, or the lack of allies. Therefore, it must pursue a strategy that allows it to retain its flexibility in when and where it will commit itself to battle. Once the decision has been made to seek battle, then the Army must ensure that its meager resources can be brought to bear in a rapid, violent fashion. Such a strategy permits the Army to conduct operations against any enemy, even if the enemy possesses certain strengths that the Army cannot match.

Why is this discussion of military strategies important to an examination of C3I? Once a nation accepts a particuliar strategy it must resource itself to execute that strategy. Once the force is structured and equipped, it is no small matter to change it. The C3I systems acquired as part of the army's acceptance of the particuliar strategy become the means by which the strategy is implemented through the use of operational art. The modus operandi for the C3I of an armed force seeking annihilation of its enemy is different from that of a force which seeks to exhaust its enemy through a combination of means. A mistake in understanding this difference may cause an army to equip itself with a C3I system similar in style to the French Army of 1940 when its command was paralyzed by the Blitzkrieg.

The translation of strategic goals into tangible end-states is the domain of the operational level of war and the operational artist. Without this connecting level tactical success becomes moot in terms of achieving the strategic goal. The United States in Vietnam is an example of an armed force dominating its enemy on the fields of battle, yet failing to achieve the strategic end-state assigned by the national leaders. Recognizing that the operational level of war is critical to the attainment of the nation's strategic goals, let us turn our attention from the strategic to the operational level.

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Field Manual 100-5, Operations, defines the operational level of war as the employment of military forces to attain strategic goals in either a theater of war or operations through the design, organization, and conduct of campaigns and major operations.(9) A striking similarity exists between this definition and Clausewitz's definition of strategy. While no specific echelon of command has the sole responsibility for planning and conducting campaigns, the responsible commander focuses on three essential points: 1) What is his assigned end-state? 2) What sequence of actions are necessary to achieve that end-state? and 3) How should his resources be applied to facilitate that sequence?

The determination of the end-state is closely related to the correct identification of the enemy's operational center of gravity, or that hub from which all power flows. It is not possible to attain one's end-state without undoing the enemy's center of gravity; any end-state short of this is superficial and risks long term failure. After having determined both the end-state and the enemy's (plus his own) center of gravity, the operational level commander must then decide when and where he would be willing to accept (or avoid) battle. This commander, now on his way to becoming an operational artist, constructs his campaign plan with its associated branches and sequels. The campaign is based upon a series of major operations that, in turn, consists of battles and engagements. The artful sequencing of the battles and engagements by the commander transforms his potential force into one of substance. The appropriate application of combat power (e.g. penetration, envelopment, exploitation) to realize the campaign's end-state is the key to practicing operational art.

The operational level commander develops his campaign plan in accordance with four general principles used by Napoleon in designing his campaigns. The first is that every campaign should have a clearly defined objective or purpose

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because without one the campaign would fritter away valuable forces. His second

principle is that the enemy's main force should be the campaign's objective; to

have seized a key piece of terrain or an important city is meaningless if the

enemy still possesses an army with which to continue the fight. Napoleon's

third principle is to maneuver his force to place it on the flank or rear of the

enemy. Lastly, the commander should attack and sever the enemy's lines of

communications while protecting his own.(10)

The complexity of the operational level of war is affected by several

additional factors. Effective linkage between an army's tactical objectives and

its strategic aims begins with the formulation of an effective doctrine, which

provides a common understanding and framework for the training, structuring, and

actions of the army. While this doctrine, based on theory, provides a positive

image to the operational level, the reality of political considerations,

interservice rivalries, protagonist parochialisms, and the physical size of the

theater cast an ominous pall over the effective utilization of the theory.(11)

The American practice of fighting at the operational level of war is

grounded in its past conduct of wars with the accompanying doctrinal, political,

and parochial baggage. Russell Weigley postulated in his study, The American

Way of War, that the US Army has long favored the strategy of annihilation and

practiced it by bringing its massive superiority of equipment and personnel to

bear on the out-manned and under-equipped enemy.(12) This practice of

annihilation was possible only through the industrial might of the United States

and served the warfighting needs of the nation well from the Civil War through

World War II. The end of World War II brought a dramatic, yet poorly

understood, change in the nature of war to the American Army. The nation, for a

variety of reasons, no longer possessed the capability of overwhelming an enemy.

Although the nation endorsed the strategies of massive retaliation, and later

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mutually assured destruction, it never regained the conventional capability to overwhelm an enemy in a theater of operations. However, the US Army continued to seek the destruction of its enemies by attriting them with firepower. Technological advancements were based on providing the biggest bang for the dollar and were manifested in the form of tactical nuclear weapons systems such as the Davy Crockett, the Honest John rocket and the 280mm atomic cannon. Doctrinally, the Army reorganized itself on the Pentomic Division concept. Over time it became apparent that such a firepower-based, nuclear-oriented concept was unacceptable because of the political/strategical implications of employing nuclear fires.

In the early 1960s the nation adopted the strategy of Flexible Response and the Army again reorganized itself so that it could support the new strategy. This new concept was the ROAD (Reorganization Objective Army Division) concept and it utilized a division formed with three brigades composed of three to five battalions each. The idea was to have a force that could be tailored tactically to meet the demands of the situation yet still possess the requisite firepower to destroy its enemy. Employed in Vietnam, the concept showed early promise, but later displayed weaknesses because of its heavy dependence upon firepower in lieu of maneuver. Once the communists realized which situations US Army units favored to fix and attrite its opponents, they sought to avoid them. The United States did not succeed in its strategy of annihilation in either Korea or Vietnam because its forces were doctrinally weak in both the operational level of war and the conduct of limited war. Despite these problems, the nation had little choice but to continue its acceptance of the strategy of exhaustion, only now it had to find the solutions to many shortcomings at both the operational and tactical levels.

In 1980 Edward Luttwak, a noted defense theorist, offered the "relational maneuver" form of warfare as an alternative to the attrition style of warfare used at the operational level of war.(13) He faulted the attrition style because it inherently led to the defeat of the weaker combatant. The weaker force tries to offset its inferiority through maximizing some form of combat power; in the United States Army this form has been its weapons technology. If any form of parity regarding weapons technology exists between the belligerents it neutralizes any advantage the weaker, or smaller, force hopes to gain from its firepower producing systems. For example, the advanced technology employed in the Army's M-1 tank force quickly becomes moot when that tank force is swarmed over by an enemy tank force that outnumbers it 5 to 1. The M-1 force will certainly destroy many enemy tanks during the fight, but the field of battle will belong to the adversary when the smoke clears.

Luttwak's concept of relational maneuver describes successful operational art as that which seeks to destroy the enemy's system of warfighting, not necessarily its forces. The prerequisite for destroying the enemy's system is an adequate knowledge of the enemy's doctrine and warfighting techniques, whereas the prerequisite for attriting the enemy is a vast abundance of resources. A higher degree of risk is entailed in seeking to destroy the system because the friendly force focuses its strength on a particular part of the enemy force in a given space and time. Taking such risk will result in greater payoffs than attrition-oriented risks that result in lower, more reliable payoffs. The assumption in relational maneuver is that the smaller force will want to gain as much as it can for every expenditure of its combat power.

Relational maneuver, both in the offense and defense, must utilize three basic elements: avoidance, deception, and momentum.(14) Comprising the basis for calculated risk-taking, these elements cannot be employed selectively or

singulary. The first element, avoidance, posits that the friendly force should avoid the main strength of the enemy as much as possible. The element of deception assists in avoiding the enemy's main strength and must be a central part of an operation's every phase. In this age of elaborate technological detection devices, deception has acquired an importance as great as the actual maneuver plan. The last element, momentum, is that intangible which propels the friendly force into the depth of the enemy's space and paralyzes enemy C3I systems. The effective employment of these elements upsets the traditional balance between firepower and maneuver by placing greater emphasis on the latter. Additionally, the firepower needed for rapid maneuver does not necessarily have to be destructive; in fact, destructive fire missions require time and thereby degrade momentum. Luttwak believes that suppressive firepower is more appropriate to relational maneuver because it maintains the friendly force's momentum. Furthermore, he supposes that the enemy will not be able to bring adequate destructive fires to bear because of the friendly force's momentum and the inability of enemy C3I to correctly react to the threat. The culmination of the relational maneuver is the collapse of the enemy's warfighting system. Luttwak concludes that the practitioner of maneuver warfare must recognize the operational level as the decisive level of war because that is where the synchronization of avoidance, deception, and momentum takes place.(15)

The skillful employment of relational maneuver produces a decisive synergism capable of offensively or defensively defeating an enemy. The premiere example of offensive relational maneuver is the German Blitzkrieg against France in 1940. The Wehrmacht attacked a decisive point that was void of the enemy's main strength; both the French and the British were convinced by German deception operations that the main attack would occur in Belgium rather

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than in the Ardennes. Thus the Allies positioned their main strengths where they expected the Wehrmacht to attack, thereby creating a lack of defensive depth in the Ardennes. This led directly to the maintenance of the German momentum once the thin Allied defenses had been penetrated. The defensive employment of relational maneuver can be found in the present-day defense strategy of Finland.(16) As a potential invasion route for Soviet units attacking into either Sweden or Norway, Finland realizes that it will quickly lose if it fights the Soviet Army along the Finnish border. The Finns also understand that the Soviets will not allow their forces to get tied up in seizing Finnish cities that do not sit astride Soviet lines of operations; rather, the Finns believe that the Soviets will attack across the barren tundra of Lappland. By allowing the Soviet columns to penetrate into the wastelands the Finns will be presented with tempting flank targets that can be attacked at will by small, mobile infantry companies. These attacks will avoid the Soviets' combat forces and will seek to destroy logistics units. Such a defensive strategy employs Luttwak's three elements of avoidance, deception, and momentum.

The Army's execution of past campaigns did not ignore avoidance, deception, or momentum, but it relegated them to a position subordinate to firepower. This was done to reduce the factor of risk in a campaign and to maximize the effects of attrition, which has been the Army's operational tool since May, 1864 when General U.S. Grant became the Army's Commanding General during the Civil War. The attrition style of war emphasized the use of massive firepower at the expense of maneuvering through and around enemy forces. Reviews of past campaigns reinforce the dominance of firepower over maneuver despite doctrinal claims to the contrary.(17) When faced with tactically superior enemy forces, such as the Wehrmacht, or when political restraints on maneuver capabilities hampered operations, such as in Korea and Vietnam, the US Army resorted to

attrition warfare. The Korean War drove home the point that big battalions do have an advantage if all other things are equal; thus, attrition warfare was chosen as the best means to defeat the Chinese hordes. In the rush to devise better ways to attrite the enemy at the tactical level the importance of maneuver at the operational level was, by and large, lost. The Army's leadership lost sight of the fact that through maneuver a force can gain a position from which to exploit its firepower.(18)

The Army undertook a bold doctrinal change in 1982 when it published the revised edition of Field Manual (FM) 100-5, Operations, introducing its new AirLand Battle doctrine. Chief among the many changes were the additions of the deep attack, maneuver-based tactics, and the concept of the operational level of war. In 1985, after three years of experimentation with the operational level of war, several problems were identified that adversely affected the Army's abilities to conduct campaigns.(19) A commonly held belief existed throughout the Army that the operational level was the domain of field armies and corps by virtue of their positions on organizational diagrams. The actual role these two types of organizations played at the operational level had yet to be fully examined. This lack of understanding resulted in the questionable force structures of these organizations. Closely tied to inadequate force structures was the problem that questioned the capability of units to maneuver freely with armored vehicles designed for close combat yet deficient in their cruising ranges. Even the ability of air-ground coordination, a recognized hallmark from the Vietnam War, was questioned as to its flexibility, responsiveness, and management. The requirements of operational art demanded effective collection and dissemination of intelligence, improved combat support/combat service support capabilities that would keep pace with the fluid battle, and a reassessment of the Army's training programs and exercises that would permit adequate exercising of operational art.

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Since 1985 intense efforts by TRADOC staffs and field commanders have sought to define the characteristics and requirements of the operational level of war. The US Army Command and General Staff College published a draft manual in 1987 that specifically addressed the operational level of war, large unit operations, and campaigns. The manual, Field Manual 100-6, Large Unit Operations, posits that the conduct of campaigns requires the operational level commander to focus his major operational functions in a manner that defeats the enemy's center of gravity by attacking its appropriate decisive points. These operational functions are intelligence, fires, maneuver, sustainment, and deception.[20] The commander influences his campaign with these functions only up to a certain point. After the campaign begins it is very difficult for the commander to make major changes because the vast scale of the campaign inhibits the commander. Therefore, the operational commander must determine his line of operation well in advance and synchronize his assets accordingly; the success or failure of the campaign will be directly related to these initial decisions.

The practice of synchronizing the major operational functions is the single most important job performed by the operational artist.[21] Campaign synchronization requires that the commander take risks in order to concentrate the requisite force to achieve the end-state. This calculated risk-taking can only succeed when subordinates are allowed the freedom of action to gain and retain the initiative when events permit their doing so. The commander must factor into his calculation the reliability of intelligence, his unit's capability to fire and maneuver, and the integration of air support. The operational artist must also provide for the sustainment of the maneuver forces.

The attainment of the war's strategic ends depends on the synchronization and application of operational level force. This synchronization and application will not be effective without some form of force control.[22] Force

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control consists of three elements that must function coherently in order for the force control system to be effective. These elements are a decision support system, communications networks, and some sensor systems. The US Army recognizes these elements as part of its C3I doctrine in the form of organizations (sensor systems), procedures (decision support systems), and facilities (communications networks). Because the Army's AirLand Battle doctrine is dynamic in its treatment of maneuver and the battlefield geometry, the supporting C3I system must also be dynamic. The failure to achieve and sustain a flexible, responsive C3I system will result in operational chaos and ultimate defeat. What, then, makes up the Army's C3I system, and just how well can it support the operational level of war?

Command, Control, Communications and Intelligence

Command, control, communications and intelligence (C3I) is the Army's specific construct for the implementation of command and control (C2). Command and control is defined by the Joint Chiefs of Staff as "the exercise of authority and direction by properly designated commanders over assigned forces in the accomplishment of their missions."(23) In this paper the term C3I refers to the institutional designs of organizations, processes, and facilities used to acquire, process, and disseminate data; such information is needed by commanders and civilian leaders to plan, direct, and control forces engaged in operations.(24)

When placed in the context of the operational level of war, C3I has been strained to its utmost limits because only one facet of its structure, the facilities, has kept pace with the changing nature of war. The technology explosion and its impact on C3I has advanced the state of military art and science to new and confusing heights. While short-term technical improvements were necessary to improve the Army's combat effectiveness, the rapid infusion of

high technology has not caused an equal amount of modernization in either the organizations or procedures associated with C3I, thus creating potential long-term problems. The retarded evolution of organizations and procedures has resulted in a disequilibrium that can create operational confusion during both combat operations and major training exercises.(25)

Closely related to the concept of C3I, but outside the purpose of this study, is one of the most dominant factors in the C3I system -- the commander. The caliber of leaders in the US Army is very high, but a highly dedicated individual faces difficult challenges overcoming the institutional obstacles found in archaic organizations and processes. The operational level commander must possess several personal attributes in order to be effective, among which are moral courage, greater foresight than his subordinates, and the "correct" personality for this level of command.(26) Additionally, the effective operational artist must have a detailed appreciation of both his intelligence and logistics systems.

The magnitude of the challenge presented by operational C3I holds the potential of great frustration for the operational artist, who might attempt to overcome it by exercising centralized C2 over his subordinate echelons. Centralized C2 would allow the operational artist to ensure that selected subordinates receive direct guidance on certain matters. Over time, however, this style of command limits the tactical freedom, autonomy, and command prerogatives of subordinates. The operational commander's centralized C2, instead of improving his command's effectiveness, actually might degrade the quality of command at lower levels.(27)

Centralized C3I, which may evolve easily from a centralized C2 style, may produce several undesired effects if the C3I system is not planned and implemented to prevent centralization.(28) The operational commander and his

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immediate staff may experience information overload caused by the massive amounts of reports, data, and messages sent to them from subordinate commands.(29) This resulting inability to provide timely responses to subordinate and superior headquarters may cause the campaign to sputter, and perhaps to fail.

Closely tied to information overload is the problem of information pathology and lack of quality feedback.(30) The term "information pathology" refers to the steady deterioration of a given item of information's usefulness caused by a commander's or staff officer's inability to act on it in a timely manner. Once the information is acted upon, the quality of the resulting decision is suspect because of information pathology and diminishes the desired effects of subordinate actions. A vicious cycle then takes hold in which inaccurate decisions lead to faulty actions, that then lead to inaccurate or faulty feedback that, in turn, fuels further inaccurate decisionmaking.

A frustrated operational commander may attempt to overcome organizational and procedural ineffectiveness by resorting to command bypassing in an attempt to gain access to those subordinates who actually execute his orders.(31) This practice can produce both tension and confusion between the several echelons of command concerned. It additionally cuts the operational commander off from the intermediate commander's interpretation of the situation. Such a practice could undo what little command and control the frustrated operational commander has left.

One final problem with centralized C3I is that its lack of flexibility could lead to exploitable vulnerabilities. The rigid centralization of communications systems can be easily identified by enemy electronic warfare units, thus identifying the location of the major bulk of signal assets, if not the command post as well. Additionally, only a small number of officers would

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possess a comprehensive picture of the campaign's progress. The loss of either these individuals or a substantial amount of signal assets might create a situation from which the force might not recover its initiative.

While it might seem that centralized C3I systems are undesirable, they are the norm at the strategic level.(32) These systems help the Joint Chiefs of Staff (JCS) maintain effective C2 over globally deployed forces and establish an accurate assessment of the global situation. An accurate, timely knowledge of the world situation is critical to the JCS's abilities to establish theater priorities and end states and to order the implementation of contingency operations. Centralized C3I also provides near real-time interaction between the JCS and the various theater commanders-in-chief located around the world. This interaction is critical to the JCS's ability to coordinate the actions of two or more theaters.

However, the C2 demands of the tactical arena differ from those of the strategic level and create the need for a C3I system that is decentralized in nature. Decentralization prevents information overload by placing operations in the hands of those individuals most capable of effectively controlling them, based either on their position in the command structure or on their functional qualifications. Senior commanders can monitor the actions and decisions of subordinates through the latters' submission of status or situation reports, thereby obtaining the necessary information needed for decisionmaking. Such a system allows for the profusion of information throughout the organization's subordinate elements and helps prevent any catastrophic loss of C2 if a major C3I element is destroyed. Additionally, the rapid, widespread dissemination of information can lead to many concurrent actions among the subordinate units. A decentralized C3I system also supports the effective use of the command and control concept known as Auftragstaktik.(33)

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The decision to implement a decentralized C3I system will not be successful without some doctrinal support. Doctrine, based on sound theory, is the key to understanding a military organization. A force's C3I theory affects its organizational patterns of authority and communications and becomes the ground upon which doctrine is built.(34) Morris Janowitz described three theoretical patterns of authority as Dominating, Manipulating, and Fraternal Order.(35) The Dominating authority pattern is based on the domination of subordinates by superiors who possess the ability to impose negative sanctions on them. The Manipulating authority pattern is based on group consensus and positive sanctions.(36) The last pattern, Fraternal Order, is characterized by technical competence, equalitarian procedures, group cohesion, and delegated authority to subordinate echelons to ensure maximum initiative and flexibility.(37) Gissin offers as examples of these three patterns the Soviet Armed Forces as practitioners of the Dominating pattern, the US armed forces as practitioners of the Manipulating pattern, and the Israeli Defense Force as the closest example of the Fraternal Order.(38) He further states that the supporting C3I doctrine must be configured with the understanding of which authority pattern is practiced in the force.(39)

Any decision to implement a particular C3I doctrine must include a means to measure the efficacy of the doctrine. This form of measurement should have an established framework that is realistic and relevant in what it measures. Gissin offers five components of such a measurement tool: organization of the chain of command, decision thresholds, decision guidelines, training, and rewards.(40)

The organization of the chain of command can be viewed as a series of layers in which the higher layers comprise the decisionmakers and the lower layers are the executors. Although the formal chain of command flows from the

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commander of one layer to the next subordinate commander, in reality much of the operational responsibility rests with the appropriate staff officers at each layer. Thus, the relationship between the staff of one layer and the line units of the next subordinate layer is one that must be considered when evaluating the organization. The efforts of all members of the organization, regardless of position, must be on improving combat readiness. The components of combat readiness, as far as organizational practices are concerned, are unity of effort, cohesiveness, and latitude of flexibility.(41)

The component of decision thresholds defines the decisionmaking boundary and authority given to a particular layer in the organization by its senior commanders.(42) These parameters can range from being tightly controlled or restricted to being very loose and flexible. Factors impacting on the type of threshold used are mission, available intelligence, acceptable level of risk, and political considerations. Closely integrated in the determination of the decision threshold is the concept of the "fog of war" and the willingness of a senior commander to allow subordinates to deal with war's inherent uncertainty. Organizations in which detailed planning is the norm usually employ a low decision threshold in order to minimize risk and uncertainty. The accompanying consequences of such a practice are the lack of flexibility in the subordinate units' actions and a rigidity in operational execution. On the other hand, organizations that stress the use of innovation and acceptance of risk taking usually have high decision thresholds.

Decision guidelines can be divided into two different types, formal and informal. These guidelines are the principles of behavior and interaction between commanders and those charged with executing their orders.(43) Formal decision guidelines can be found in regulations, standard operating procedures, and orders, while informal guidelines are rooted in acceptable behavior and

interactive styles. An example of the latter guideline may be seen in the

informal staff coordination between a division G3 and a subordinate brigade S3

in which the G3 directs the S3 to plan a specific operation. Tension between

the formal and informal guidelines is always present in any organization and

must be accommodated by the organization's members. The C3I system affects this

tension because its technological advantages may proscribe a formal guideline;

for example, a formal guideline stating that commanders must lead from the front

may be subverted by C3I technology that permits the senior commander to remain

in his command post and talk with his subordinate commanders via telephone or

radio. The British Army of World War I was notorious for this practice, which

resulted in senior commanders being unaware of events occurring along the

frontline. The potential flexibility of a C3I doctrine, therefore, is dependent

both upon the decision guidelines practiced by a force and the leadership's

willingness to employ the C3I system to its full capabilities.

Different combat organizations adhere to different doctrines and,

consequently, different C3I systems. These differences are also found in the

type of training practiced by these organizations. Gissin suggests that

differences in C3I training doctrines can be evaluated critically by examining

the amount of latitude given subordinate commanders in the planning and

execution of operations, and the degree of difficulty built into such operations

in the form of uncertainty and confusion.(44) The value of injecting

uncertainty, confusion, and friction into an exercise is the pressure put on

commanders to seize the initiative and accept risk in performing operations. A

conscienticus effort must be made to ensure the presence of the fog of war in an

exercise. Gissin suggests that most leaders desire training exercises that

reinforce "by the book" solutions and to not seek innovative solutions. A force

will fight the way it is trained; if textbook solutions are what the commander

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desires, that is what his force will seek in combat. Rarely have training conditions matched the intensity of combat conditions, and the shock of this mismatch may set the stage for disaster.

The final element used by Gissin in evaluating C3I systems is rewards.(45) Organizations must structure their rewards systems in a manner that encourages risk taking and initiative by subordinates. If the subordinate leaders perceive that the C3I system punishes individuals for taking the initiative, then innovation will be stifled.

Although Gissin uses these five elements to describe and evaluate C3I systems, these elements also are applicable in describing any leadership style. Therefore, it is possible to envision many different leadership styles and supporting C3I systems based on these elements. A perspective on the US Army's C3I system can be gained by reviewing the two possible extremes structured with these five elements. The unrestricted C3I system is characterized by high decision thresholds and flexible guidelines.(46) Its C3I system allows for informal communications between echelons, demands high levels of military competence, and emphasizes mission accomplishment through innovation. Such a system places a premium on initiative and the ability of a leader to divert from the original plan and execute a branch of the plan. If subordinate leaders understand their commander's intent, then this type of C3I system would be of immense value to a force fighting on a fluid battlefield. At the opposite end of the spectrum is the restricted C3I system.(47) It relies on textbook execution of missions, low decision thresholds, centralized planning, and a rewards system that fails to endorse innovation or risk taking. Sudden changes in situations can confound this system and slow down its ability to provide command and control to the force.

The US Army's doctrine for C3I presupposes the use of mission-oriented C2 and relies on a system that facilitates the commander's decisionmaking process.(48) This facilitation requires that the C3I organization be capable of predictive planning. Predictive planning requires that the commander and staff possess an understanding of the enemy's doctrine and have developed indicators that will reveal the enemy's intent. The C3I system's intelligence assets must be focused on designated areas where intent indicators may operate. Predictive planning also must have rapid means of communications available for the transmitting of information from the intelligence asset to a command post (CP) where the commander and staff can analyze the data and facilitate the decisionmaking process.(49)

The US Army's C3I doctrine also requires that CPs be echeloned in the area of operations so that a higher headquarter's CP generally is never forward of a subordinate headquarter's CP. The CPs must be interconnected by redundant and mutually supporting communications means. All CPs must be flexible in their configuration so that they can rapidly set up or displaced and be manned by highly trained staff personnel. All activities in the CPs must orient on the effective synchronization of operations.(50) The ultimate goal of the CP is the ability to rapidly execute one cycle of Boyd's concept of C2, the OODA Loop (Observe - Orient - Decide - Act).(51)

Several authorities contend that C3I systems are intended to reduce uncertainty and provide necessary decisions for combat operations.(52) Snyder contends that the paramount decision of a C3I system is the acceptance to engage the enemy and the timing of the reserves' commitment.(53) He further states that the system must be capable of reducing the time necessary to develop this paramount decision.(54) One way the system can help the commander make the quick decision is through the filtering of information so that only the

pertinent information is brought to the commander's attention. Schmidt cited a study suggesting that decisionmakers perform better if the number of pertinent facts concerning a situation is kept to a maximum of four.(55) The advantages provided by an effective C3I system are force multipliers that compensate for other weaknesses in the command.(56) Despite this potential advantage, a commander's fear of the unknown and his quest for certainty can subvert the C3I system to a point of virtual inefficiency.(57)

Despite the findings of these authorities, the Army's C3I system can be characterized as centralized in its planning, inflexible in its execution, fixated on facilities improvement, and unrealistic in its training. Army leadership continually views the C3I system as technology dependent, which usually places the system in the domain of the Signal Corps.(58) This organizational narrowness of vision during the critical time when operational art is being introduced to US Army doctrine is dangerous because decisions endemic to the development of operational level C3I may force the Army to accept a system that is unsuitable for its needs. What, then, are the operational C3I needs of the Army?

Operational C3I

During World War II operational level commanders frequently were frustrated by a subordinate's misunderstanding of the concept of an operation. Sometimes it would be too late for the commander to correct the subordinate's mistake and the campaign plan would be thrown off course.(59) Those problems exist today and now are compounded by high speed C3I systems that transform planning mistakes into faulty action, redeemed only with the cost of soldiers' lives. These C3I systems transmit whatever information is entered into them, however false it may be; the wise commander attempts to confirm suspicious information through other sources.(60) These efforts require time and degrade the

effectiveness of the C3I systems to provide timely feedback. Despite these pitfalls, operational level commanders are responsible for improving their C3I systems and their requirements are the only valid standards for improving the systems. The commander must review his C3I system continually and be dedicated to making necessary improvements.(61)

Command

The operational level commander must ensure that several requirements are satisfied by his C3I system. The system must allow the commander to detect an indicator of enemy intentions speedily, analyze the indicator, establish his priorities, and take appropriate action.(62) The C3I system must allow the commander to place his decisions in the wider context of political/military affairs since operational level actions have weighty political implications.(63) Additionally, the system must enable the commander to consult/coordinate with other forces not under his direct command, especially if his force is part of a coalition effort.(64) Finally, effective C3I also must clearly communicate the commander's intent, the subordinate's tasks, the requisite resources, and any operational constraints.(65)

An operational level C3I system must permit the commander and his subordinates to establish a commonly shared mind-set conducive to mission-type orders and command flexibility. One concept supportive of such a mind-set is _Auftragstaktik_. This term, although difficult to translate into English, describes the German command style that has been practiced by the German Army since its development by Molkte the Elder in the 19th century.(66) The five elements that best describe its nature are speed in decisionmaking, seizure of the initiative by leaders at all levels, decentralized decisionmaking, flexible leadership, and solid, trustworthy leaders.(67) _Auftragstaktik_ is invaluable in establishing and sustaining a decentralized command system necessary for the maneuver warfare called for by FM 100-5.

The scope of modern warfare stresses the cognitive capacity of any commander, who nevertheless must accomodate that stress. One method useful in coping with war's wide scope is the "directed telescope," a term applied to the various means commanders use to aid them in obtaining information. Several types of "directed telescopes" have been used throughout time, ranging from passive couriers to active executive agents.(68) Today's "directed telescopes" consist mainly of observers/evaluators and executors. The former category is best typified by liaison officers who assess capabilities, recommend changes, and evaluate "intangibles."(69) The best example of executors was the Prussian General staff officer who had the authority to convey and interpret the commander's intent and direct operational changes as necessary. The "directed telescope" concept can support AirLand Battle C3I by providing subordinates a clear understanding of the commander's intent. A "directed telescope" allows subordinate commanders to exercise greater decisionmaking because of their greater comprehension. The new emphasis on operational synchronization should encourage commanders to use the "directed telescope" as a means to ensure rapid coordination of efforts.(70) The application of advanced technology may be useful in this instance, if the requirements are thought through sufficiently.

The effectiveness of a C3I system is partially dependent upon a command's organizational structure and institutional flexibility. The structure must ensure unity of command to prevent subordinates from receiving conflicting guidance from other authorities. While this problem may not be significant in a mid- or high-intensity environment, a low-intensity environment controlled by a country team, consisting of numerous representatives from governmental agencies with intricate command relationships, may create confusion for a subordinate military echelon. In addition to unity of command, C3I systems must possess a degree of organizational flexibility that allows them to adapt to a campaign's

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specific needs.(71) The successful operational level commander contributes to an effective C3I system through the development of close, personal relationships between himself and his subordinate commanders.(72) The result of the combination of an effective organization, institutional flexibility and an involved commander is the creation of higher decision thresholds that allow subordinates the freedom of action with which to seize the initiative.

Although many tactical leaders can seize the initiative and know when they have seized it, the operational leader may not find seizing the initiative so clear cut and definable. Modern warfare, especially at the operational level, characteristically is confusing due to the fog and friction of war.(73) Compounding the effects of fog and friction is the speed afforded by modern communications means; these means not only transmit information that clarifies matters, but they just as quickly speed confusing or conflicting information through the system. When presented with information, the decisionmaker must determine its accuracy while more information is constantly arriving. Despite this challenge the operational leader must make rapid assessments of the situation based on incomplete information. The commander must be willing to take calculated risks and understand the tenuous nature of risk taking. He must transmit his intentions and plans rapidly so that his subordinates can execute the decision.(74)

To make these hard decisions the operational level commander must depend upon his command element's abilities to analyze and synchronize operations. The commander and his staff must consider joint and combined operations, intelligence activities, and logistics support. The command element charged with synchronizing operational activities must synchronize operations in a multidimensional manner in terms of time, space and force employment.

To satisfy the multidimensional needs of the operational level commander the C3I system must satisfy several theater-specific requirements.(75) The first requirement is the need to assess the enemy's long range intentions. The C3I system must accomplish this assessment so the commander's freedom of action to conduct either offensive or defensive operations is maintained. The C3I system must also expand the commander's view of time and space so he can focus on future operations. This farsightedness enhances the commander's ability to sequence both battles and operations, and to integrate air, land, and naval forces into his campaign concept.

Control

The centralized control method, one method of C3I, produces information overload, one of its major deficiencies. How does information overload impact on the operational level headquarters? Information overload creates backlogs of reports from subordinate units and reduces the speed with which orders or reports are dispatched. This in turn causes the commander and his staff to neglect an essential item of information in their efforts to catch up. The solution to this problem is the prevention of information overload through the development and implementation of effective C3I doctrine, organization, and training, not through the singular application of advanced C3I technology.

Two other problems associated with centralized command, information pathology and inadequate feedback, cannot be solved as easily as information overload. Information pathology, and its inherent cycle of self-generated erroneous information and inappropriate action, raises the issue of information quality. The quality of information is based on an organization's command style and its command climate.(76) Information quality and its flow through a C3I system is adversely affected by either a lack of mutual trust between various echelons of command or leader continuity, or the number of echelons in an

organization. Commanders must establish face-to-face relationships with subordinates and maintain them, even during combat. Such relationships ensure a high degree of trust between a senior and his subordinates. Additionally, the resulting feedback exchanges between the two levels contributes to greater operational flexibility. During the Yom Kippur War the Israeli Defense Force credited such relationships for its successful flexibility even when its communications systems were degraded in the early stages of the war.(77) An effective command style directly contributes to effective communications and control. Without such effectiveness all of the latest communications technology and control techniques would be futile. A poor command style, coupled with today's communications, most likely will cause a rapid degradation of operational effectiveness. Effective communications will not filter out bad command decisions; it will only accelerate the organization's loss of control. On the other hand, these same communications may make a bad decision obvious in time to correct it.

Additional weaknesses in the centralized command style exist. The increased capabilities of threat electronic warfare units heighten the danger of destruction for any command post. A cluster of communications equipment, vehicles, and C2 assets presents an outstanding target to threat detection teams. Another weakness is the commonly held belief that joint or combined interoperability is improved by gathering all the various subordinate command and staff elements in one location. Such proximity will not reduce service parochialism, bureaucratic in-fighting, or differences in operating procedures. These problems will not be resolved by either collocating the concerned elements or by employing improved communications means.

An alternative to the centralized command style is what Janowitz calls the Fraternal Order system.(78) This control system places the burden of mission accomplishment on those echelons assigned to carry it out. A large degree of latitude is delegated to these echelons in detailed planning and decision thresholds. Senior commanders reserve the right to intervene on a selective basis during the conduct of combat operations, but the grounds for such intervention must be clearly delineated in doctrine and understood by all commanders. The Fraternal Order system is based on organizational coherence and consistency that allows the chain of command flexibility in its control of operations. This flexibility allows subordinate leaders to exercise high decision thresholds for the purpose of taking calculated risks to achieve mission goals. Underpinning such a command style is the presence of close trusting relationships between senior and subordinate commanders. These relationships are developed by senior leaders who set the example; although setting the example for all subordinates to see may not be possible for the operational level commander, he must have demonstrated his credibility earlier in his career. This creditability should be based on mission accomplishment and concern for troop welfare and survival.

Historically, the United States has suffered rigidity in its command and control structures in the first engagements of its various wars.(79) Based upon his review of several battles, John Shy concludes:

> ...the professional response to the chronic American
> weakness in command and control was to plan more thoroughly,
> leaving as little to chance as possible. But thorough
> planning, with its natural deemphasis of unexpected
> situations (beyond the scope of contingency plans), led to
> rigidity and, often, heavy losses. In other words, the
> command and control weakness and its chosen professional
> remedy were but two aspects of a single larger problem:
> inadequate preparation of commanders and staffs for the real
> world of combat.(80)

The issue of control must be addressed further in the Army's C3I doctrine.
If a commander decides that his C3I doctrine will incorporate both centralized
and decentralized control methods, then it must allow commanders the discretion
and ability to switch from one mode to the other. This would enable each
command level the freedom to initiate action without having to obtain higher
headquarter's approval. Additionally, the use of the decentralized command mode
would reduce both the amount of communications received by higher headquarters
and the chance of information overload. Such a doctrine would demand that a
consistently high level of trust be established between the various levels of
command.

Communications

One major area that traditionally has been neglected by commanders and
relegated to specialists is the third element of a C3I system, communications.
In recent years communications has received a great deal of attention because of
its importance in linking different C2 elements together to form one cohesive
system. Additionally, in years of decreasing military budgets, communications
has been scrutinized because of its large budget allocations.

In the past, the United States has never suffered the loss of
communications at the operational level. The failure of C3I systems to prevent
catastrophes, such as the surprise attack on Pearl Harbor, is attributed to
failures in the areas of command and control.(81) In today's fast-paced world a
breakdown in communications at the operational level, such as within a theater
command structure, can have devastating effects. The ability to synchroninze
the various elements of different services or countries would degrade and
prevent the successful execution of joint or combined operations.

Operational level communications will be extensive in scope and challenged by both user requirements and enemy electronic warfare actions. Our Vietnam experience suggests that such communications will provide commanders with a powerful C2 tool, but at the same time expose several vulnerabilities, both physical and psychological.(82) Isolated signal sites need to generate power and to erect large antennas, which mark them as potential targets. The use of the electromagnetic spectrum opens the C3I system to possible enemy exploitation. Enemy deception efforts are aided by the speed with which our signal systems can communicate. Additionally, these same systems permit commanders to bypass intermediate command levels and communicate with lower levels, thereby losing the advice and interpretation of the bypassed commanders.

Operational level communications must focus on supporting the five operational functions of large unit operations -- intelligence, maneuver, fires, sustainment, and deception.(83) Such communications must adhere to five principles -- continuity, homogeneity, versatility, security, and simplicity.(84)

Continuity is defined as "...the uninterrupted availability of communications...to provide the commander (and his staff) correct information which enables him to exert his will on combat operations, to mass available resources, and to synchronize dispersed supporting activities."(85) The primary advantage of continuous communications is that the operational commander can maneuver his forces before combat and secure positional advantages over the enemy. Following the battle the commander can exploit his various tactical successes to continue the enemy's destruction and secure his operational goals. Continuous communications between various headquarters aids the application of operational fires throughout the depth of the theater of operations, especially those fires provided by air force units. Finally, the operational commander can

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rely on continuous communications to help focus his logistics efforts in developing support bases and lines of communications.

The two operational functions of intelligence and fires are aided by the communications principle of homogeneity, or the "uniform means and methods to achieve integrated C3I information acquisition and transfer."(86) This principle aids in synchronizing the various capabilities of operational forces so that campaign actions can be sequenced effectively. Homogeneity is the result of selecting C3I system assets that are compatible with one another, a characteristic that has eluded the US armed forces for years. Operation URGENT FURY was "...plagued by the forces' inability to communicate, a problem caused by the services continued practice of buying radios that are not compatible."(87) The intelligence function requires homogeneity if its product is intended to move from any of its numerous collectors to the operational user. Additionally, operational fires that rely on target data developed by one element and fired by another must be supported by homogeneous communications systems.

Change is the norm in warfighting and the successful commander is one who can adapt best to it. Changes require operational communications to be versatile or "capable of adapting readily to unforeseen C3I requirements."(88) Closely related to the principle of continuity, versatility enhances the operational commander's ability to seize and retain the initiative. It aids in synchronizing three operational functions -- maneuver, fires, and sustainment. The commander who effectively uses his C3I system to exploit unforeseen changes will gain an advantage that may create operational success. However, this advantage is realized only when the commander maneuvers his forces to a position from which fires can be directed on enemy forces. Additionally, versatile communications assist the sustainment of forces once they have taken their new positions.

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Clausewitz stated that surprise lies at the root of all operations and that the further one got away from the tactical level the harder it was to achieve surprise.(89) This characteristic difficulty at the operational level requires that _security_ be applied to all five operational functions, but especially to deception, maneuver, and intelligence. _Security_ in C3I aids in denying and deceiving the enemy's detection efforts about the US commander's intentions and purposes.(90) Deception is of central importance to the operational commander and assumes a status co-equal to the actual campaign plan.(91) Deception is impossible without adequate security and without deception the commander cannot achieve surprise. Security is also necessary for the safe maneuvering and massing of combat forces at a decisive point; the failure to protect forces during this vulnerable stage exposes them to enemy preemptive attacks, such as those the Israeli Defense Forces conducted against Arab forces in 1967. Security in C3I systems must address how intelligence is handled, especially among allies. Source protection must be maintained and decisions made about who receives sensitive information. Communications systems must be designed to ensure this protection and afford sources every possible means of protection.

Simplicity in C3I systems refers to the ease with which the system can be used by a commander and his staff.(92) This not only refers to the organizational structure that Gissin cited as an evaluative element of C3I, but simplicity also includes the level of sophistication required by a user to master available communications technology. Simplicity in C3I systems has great impact on the commander's abilities to control his forces' maneuver, fires, and sustainment. If the provided technology is too complex for C3I personnel to master, the operational commander might become what one defense analyst described as "Gen. Gamelin sitting in front of a computer."(93) On the other hand, if the provided technology is perceived by the forces as detrimental to

another operational characteristic, such as versatility, the technology may be discarded as a liability.(94)

Intelligence

The importance of the final element of the C3I system, intelligence, cannot be stressed enough at the operational level war. Throughout the history of the United States intelligence failures abound. These failures have been common in the post-World War II era -- MacArthur's failure to assess Chinese intentions in Korea, the missed indicators of the Tet offensive in 1968, the failure of the Iranian rescue mission, the loss of the Marine contingent in Beirut, and the inability to estimate enemy forces in Grenada, to cite a few examples. Operational level warfare demands that commanders have accurate and timely intelligence. However, in today's high technology world it is popular to devise new, indirect methods of collection that rely upon high-grade technical assets. History shows time and again that the best intelligence is that which is developed from the ground up and not from remote sources, such as satellites.

Intelligence collection and dissemination must be done in consonance with the commander's intent. As a campaign plan develops, the commander's desire for information becomes what Van Creveld calls the "Quest for Certainty."(95) Operational level commanders must be wary of their insatiable appetite for information because their numerous sources may overtax their C3I system and cause information overload. If a commander wants to be absolutely certain about every aspect of a pending campaign, he places himself at a disadvantage. Intelligence should provide the commander with enough information to develop necessary calculated risks that aid the attainment of the operational end-state.

Conclusions

This study is by no means the final word on the subject of C3I. In fact, the more questions it raises, the better the Army will be for it. Command, control, communications and intelligence is a multifaceted and complex area that has received little attention as an aggregate. Much has been written concerning command and control, but in war these two elements cannot operate in their own world; both must be supported by communications and intelligence. The Army's C3I doctrine must be designed to support its declared combat doctrine, AirLand Battle, and the doctrine's reliance on maneuver warfare. This effort should develop a C3I concept that addresses all four elements of C3I without undue emphasis on technology. Furthermore, the concept must resolve the inherent tension that exists between two of AirLand Battle doctrine's tenets - initiative and synchronization. It is possible that an operational commander could smother his subordinates' initiative in the name of synchronization. Where and how does the commander balance the two?

Command

The first and most important conclusion is the need for the Army to develop a C3I doctrine based on the principles of _Auftragstaktik_ and the Fraternal Order Command system. Such doctrine must stress both the concept of decentralized command and the principle of unity of command throughout the operational level organization. The doctrine must affect all services acting at the operational level. The officer corps must establish within its ranks a common bias or mind set for a C3I concept to be effective. Is this possible and, if so, how is it accomplished?

The Army's current organizational breakpoint between the operational and tactical levels of war has created a handicap in its C3I doctrine that affects its abilities to effectively gain a desired end-state. The current C3I

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doctrinal publication, Field Circular 101-55, Corps and Division Command and Control, suggests through its omission of discussion that these two echelons operate at the tactical level, not the operational level, of war. Recent operations in Grenada (1983) and Honduras (1988) indicate that corps may be important echelons at the operational level. The British operation to regain the Falklands also suggests that the operational level of war is not the domain of any specific echelon of organization.(96) Our experience in Central America and Vietnam should tell us that echelons from corps through field army are important actors at the operational level. If the C3I doctrine makes a distinct break between divisions and corps on one hand and echelons above corps on the other, will our corps be capable of exercising effective C3I when executing operational level campaigns? Additionally, will corps headquarters possess the capability to interface with its higher headquarters, air, naval, and allied forces effectively?

The solution to this particular problem is the development of a C3I doctrine for operational level echelons, to include corps and field armies. The Army actively must seek to exercise field army headquarters and shelve the use of arm groups until that time when the force structure requires their need. A field army could lighten the logistics burden currently carried by the corps structure so that the corps is more maneuverable. A field army headquarters could provide better command to its subordinate echelons because its organization would possess the necessary personnel and assets to operate in both joint and combined operations.

Control

The commander and his staff must control those functions vital to operational success -- intelligence, maneuver, fires, sustainment, and deception. Some of these functions may require tighter forms of control than

the others. For example, an operational commander may want to tightly control his intelligence function in order to ensure security based on the need to know, such as how "Ultra" and "Magic" intelligence were treated during World War II. On the other hand, the commander may grant subordinates a wide degree of latitude in the function of maneuver. Effective control should reduce organizational friction caused by the large number of echelons involved in decisionmaking and streamline those organizations charged with conducting campaigns and major operations.

Control means based upon advanced technology, such as the Maneuver Control System (MCS), should be integrated carefully into the C3I system to prevent undesirable and unforeseen effects from degrading the original purpose. Command and control are closely wedded to each other and a fault in one will adversely affect the other. If not handled correctly, MCS may cause some commanders to become tied to the system, thus diverting them away from their traditional leadership roles. The effect may be an increase in a commander's unintentional use of centralized command at an inappropriate level.

The C3I doctrine also must address the requirements of joint and combined operations and the control of participating forces. The operational commander must control these forces in all five functional areas or risk a breakdown in the effective synchronization of the campaign. Operation URGENT FURY, with its failures in coordinated naval fires, erroneous intelligence reporting, and uninspired maneuver, failed to set a standard for effective operational art.

Communications

Communications, the binding element of C3I, has undergone significant improvements over the last several years. However, these technological improvements must support the complete C3I system, not just attempt to supplant a weak element of C3I. The Mobile Subscriber Equipment (MSE) system provides

commanders at the tactical level with the capability to communicate with almost

any commander anywhere in a corps area. While this provides a commander with a

powerful C2 tool, MSE should not be viewed as a means to correct a commander's

lack of effective control within his organization. Additionally, MSE can lure a

commander into a centralized command style if he does not actively prevent it.

Any family of communications equipment must be capable of dynamic, rapid

movement throughout the theater of operations. Signal units at the operational

level must be capable of keeping pace with combat forces and have the same

degree of protection as the unit it is supporting. Such signal units must

provide the operational headquarters, be it corps or theater, the same quality

of service that MSE provides tactical headquarters. Finally, operational

communications must adhere to Fincke's principles -- continuity, homogenity,

versatility, security, and simplicity.

Intelligence

Intelligence is the one element of the C3I system that most requires

centralized control. The operational commander must carefully assess his needs

when preparing his intelligence collection plan to prevent the "Quest for

Certainty" from inhibiting his campaign plan's development. The intelligence

collectors must understand the operational commander's intent and focus their

collection efforts on those needs that support the intent. Intelligence

managers must not overlook information that might block the campaign plan's

success, even if the information was not part of the original collection plan's

requirements.

Operational commanders must ensure that their intelligence managers are an

integral part of the operational C3I system. The commander must demand that

procedures be established to quickly disseminate intelligence throughout a

decentralized command system. A major part of this integration is the effective

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ability of intelligence collection systems to interface with the supporting communications systems.

In conclusion, ancient mythology placed Jupiter as the king of gods and men, and he was served by Mercury, his messenger. Mercury exhibited great speed, skill, and dexterity in carrying his king's commands. Military signal services throughout the world adopted Mercury as the symbol of effective communications in war. Times have changed since those days of Olympian gods and yet the Signal Corps is still expected to continue in the tradition of Mercury. Today, would Mercury himself be capable of dealing with the complexities of C3I at the operational level of war?

ENDNOTES

1. F.E. Dierksmeier. "The Impact of MSE." *Military Review*, *67*, (8), p. 40.

2. J. Babcock. "Tactical Communications -- The Linkage between C2 and I." *Signal*, *35*, (3), p. 15; R.A. Beaumont. "The Tactical Spectrum and C3 State Variance: Accomodating Uncertainty." *Signal*, *35*, (7), p. 49.

3. H.G. Summers, Jr. "How We Lost." *The New Republic*, 1985 (April 29), p. 20.

4. Department of the Army (DA). FM 100-5, *Operations* (Washington, D.C.: Department of the Army, 1986), p. 9.

5. C. von Clausewitz. *On War*, edited by M. Howard and P. Paret (Princeton, NJ: Princeton University Press, 1976), p. 177.

6. G.A. Craig. "Delbruck: The Military Historian." In *Makers of Modern Strategy*, edited by E.M. Earle (Princeton, NJ: Princeton University Press, 1971), p. 272 - 273.

7. Ibid.

8. M. Tukhachevskiy, as cited in J.J. Schneider. *The Theory of Operational Art*, (Ft. Leavenworth, KS: School of Advanced Military Studies, 1988), p. 12.

9. DA, FM 100-5, *op. cit.*, p. 10.

10. Schneider, *op. cit.*, p. 8.

11. J.L. Buckley. *An Analysis of US Army C2 Organization in the Pacific Theater, World War II to 1983* (Ft. Leavenworth, KS: School of Advanced Military Studies, 1983), p. 11.

12. R.F. Weigley. *The American Way of War* (Bloomington, IN: Indiana University Press, 1977), p. xxii.

13. E.N. Luttwak. "The Operational Level of War." *International Security*, *5*, (3), p. 61 - 79.

14. Ibid., p. 70.

15. Ibid., p. 73.

16. Ibid., p. 73 - 76.

17. G.M. Harned. "Quality versus Quantity: Limits of Operational Art." *Army*, *36*, (6), p. 40.

18. Ibid.

19. L.D. Holder. "A New Day for Operational Art." Army, 35, (3), p. 30.

20. Command and General Staff College (CGSC). FM 100-6, Large Unit Operations (Coordinating Draft) (Ft. Leavenworth, KS: CGSC, 1987) p. 3-7 - 3-22.

21. W.E. DePuy. "Toward a Balanced Doctrine." Army, 34, (11), p. 20.

22. E.A. Berman. "Balancing Force and Force Control." Signal, 42, (1), p. 99.

23. Department of Defense (DOD). JCS Pub 1, Dictionary of Military and Associated Terms (Washington, D.C.: DOD, 1986), p. 77.

24. R. Gissin. Command, Control, and Communications Technology: Changing Patterns of Leadership in Combat Organizations (Syracuse, NY: Syracuse University, 1979), p. 5.

25. E.N. Luttwak. The Pentagon and the Art of War (New York: Simon & Schuster, 1984), p. 55; and personal knowledge acquired during REFORGER, 1982.

26. G.C. Gardner. Generalship in War: The Principles of Operational Command (Ft. Leavenworth, KS: School of Advanced Military Studies, 1987), p. 35.

27. Gissin, op. cit., p. 29.

28. Ibid.

29. Ibid.

30. Ibid.

31. Ibid., p. 30.

32. G.E. Orr. Combat Operations C3I: Fundamentals and Interactions (Maxwell AFB, AL: Air University Press, 1983), p. 87.

33. J.T. Nelson, II. Where to Go from Here? Considerations for the Formal Adoption of Auftragstaktik by the US Army (Ft. Leavenworth, KS: School of Advanced Military Studies, 1986), p. 30.

34. Gissin, op. cit., p. 48.

35. M. Janowitz. Military Conflict (Beverly Hills, CA: Sage Publications, 1975), p. 226.

36. Ibid., p. 226 - 228.

37. Ibid., p. 233 - 236.

38. Gissin, op. cit., p. 49.

39. Ibid., p. 50.

40. Ibid., p. 51.

41. Ibid., p. 52.

42. Ibid., p. 55.

43. Ibid., p. 57.

44. Ibid., p. 62.

45. Ibid., p. 65.

46. Ibid., p. 66.

47. Ibid.

48. Command and General Staff College (CGSC). FC 101-55, Corps and
Division Command and Control (Ft. Leavenworth, KS: CGSC, 1985), p. 1-11.

49. Ibid.

50. Ibid., p. 1-12.

51. Orr, op. cit., p. 26.

52. For further information regarding uncertainty, see FC 101-55, Van
Creveld, Snyder, Schmidt, Gissin, and Orr.

53. F.M. Snyder. "Command and Control and Uncertainty." Naval War
College Review, 23, (2), p. 109.

54. Ibid.

55. T.C. Schmidt. Tactical Information Gathering in the High Technology
Command and Control Environment: A Division Commander's Challenge (Ft.
Leavenworth, KS: School of Advanced Military Studies, 1985), p. 8.

56. M. Van Creveld. Command in War (Cambridge, MA: Harvard University,
1985), p. 1 - 3.

57. Ibid., p. 256.

58. See briefings by BG J.H. Granrud to the 1986 AUSA Convention (DTIC
Number ADB 101334) and by MG G.R. Sullivan to the 1987 AUSA Convention (DTIC
Number ADB 111701).

59. R.F. Weigley. Eisenhower's Lieutenants (Bloomington, IN: Indiana
University Press, 1981), p. 182 and J.L. Devers. Major Problems Confronting a
Theater Commander in Combined Operations (Ft. Leavenworth, KS: Command and
General Staff College, 1947), p. 2.

60. P. Harding. "C3I Supporting the Commander's Game Plan." Signal, 42, (2), p. 29.

61. G.L. Waldrop. The Role of Requirements Analysis in Command and Control Systems (Ft. Leavenworth, KS: Command and General Staff College, 1981), p. 23.

62. Harding, op. cit., p. 28.

63. Ibid.

64. Ibid.

65. R.E. Simpkin. Race to the Swift: Thoughts on Twenty-First Century Warfare (London: Brassey's Defense, 1985), p. 239.

66. Nelson, op. cit., p. 3.

67. Ibid., p. 5 - 20.

68. G.B. Griffin. The Directed Telescope: A Traditional Element of Effective Command (Ft. Leavenworth, KS: Combat Studies Institute, 1985), p. 29.

69. Ibid.

70. Ibid., p. 30 - 31.

71. H.S. Tuttle. The Use of Command and Control to Enhance Agility and Achieve Synchronization on the AirLand Battlefield (Ft. Leavenworth, KS: School of Advanced Military Studies, 1986), p. 36.

72. Gissin, op. cit., p. 455.

73. C.R. Newell. "Fog and Friction: Challenges to Command and Control." Military Review, 67, (8), p. 19.

74. S.E. Runals. Command and Control: Does Current US Army Tactical Command and Control Doctrine Meet the Requirements for Today's High Intensity Battlefield? (Ft. Leavenworth, KS: School of Advanced Military Studies, 1985), p. 36.

75. Bundesministerium der Verteidigung -- Inspekteur des Heeres. Operational Guidelines (Bonn, FRG: Bundesministerium der Verteidigung, 1987), p. 10.

76. Gissin, op. cit., p. 441.

77. Ibid., p. 442.

78. Janowitz, op. cit., p. 226 - 238.

79. J. Shy. "First Battles in Retrospect." In _America's First Battles, 1776 - 1965_, edited by C.E. Heller and W.A. Stofft (Lawrence, KS: University Press, 1986), p. 330.

80. Ibid.

81. G.W. Prange. _Pearl Harbor: The Verdict of History_ (New York: McGraw Hill, 1986), p. 212 - 232.

82. J.D. Bergen. _Military Communications, A Test for Technology_ (Washington, D.C.: Center of Military History, 1986), p. 473 - 479.

83. CGSC, FC 100-6, _op. cit._, p. 3-7.

84. D.E. Fincke. _Principles of Military Communications for C3I_ (Ft. Leavenworth, KS: School of Advanced Military Studies, 1986), p. 8.

85. Ibid., p. 10.

86. Ibid., p. 22.

87. S. Nunn. "Defense Organization: The Need for Change." _Armed Forces Journal_, _123_, (4), p. 14.

88. Fincke, _op. cit._, p. 31.

89. Clausewitz, _op. cit._, p. 198.

90. Fincke, _op. cit._, p. 47.

91. Luttwak, _op. cit._, p. 70.

92. Fincke, _op. cit._, p. 57.

93. Personal conversation with William Lind, defense analyst, during his visit to SAMS, December, 1987.

94. Bergen, _op. cit._, p. 477.

95. Van Creveld, _op. cit._, p. 256.

96. Ministry of Defense, United Kingdom. Army Training Note 19, _The Operational Level of Command_ (London: Ministry of Defense, 1987), p. 19-1.

<u>BIBLIOGRAPHY</u>

<u>Books</u>

Bergen, J.D., <u>Military Communications, A Test for Technology</u>. Washington,
    D.C.: Center of Military History, 1986.

Bundesministerium der Verteidigung -- Inspekteur des Heeres, <u>Operational
    Guidelines</u>. Bonn, FRG: Bundesministerium der Verteidigung des Heeres, 1987.

Clausewitz, Carl von, <u>On War</u>. Princeton, NJ: Princeton University Press, 1984.

Craig, G.A. "Delbruck: The Military Historian" in <u>Makers of Modern Strategy</u>,
    edited by E.M. Earle. Princeton, NJ: Princeton University Press, 1971.

Cushman, J.H., <u>Organization and Operational Employment of Air/Land Forces</u>.
    Carlisle Barracks, PA: US Army War College, 1984.

Griffin, G.B., <u>The Directed Telescope: A Traditional Element of Effective
    Command</u>. Ft. Leavenworth, KS: Combat Studies Institute, 1985.

Gissin, R., <u>Command, Control, and Communications Technology: Changing Patterns
    of Leadership in Combat Organizations</u>. Syracuse, NY: Syracuse University,
    1979.

Janowitz, M., <u>Military Conflict</u>. Beverly Hills, CA: Sage Publications, 1975.

Luttwak, E.N., <u>The Pentagon and the Art of War</u>. New York: Simon & Schuster,
    1984.

Orr, G.E., <u>Combat Operations C3I: Fundamentals and Interactions</u>. Maxwell AFB,
    AL: Air University Press, 1983.

Prange, G.W., <u>Pearl Harbor: The Verdict of History</u>. New York: McGraw Hill,
    1986.

Shy, J., "First Battles in Retrospect" in <u>America's First Battles, 1776 - 1965</u>,
    edited by C.E. Heller and W.A. Stofft. Lawrence KS: University Press, 1986.

Simpkin, R.E., <u>Race to the Swift: Thoughts on Twenty-First Century Warfare</u>.
    London: Brassey's Defense, 1985.

Van Creveld, M., <u>Command in War</u>. Cambridge, MA: Harvard University, 1985.

Weigley, R.F., <u>The American Way of War</u>. Bloomington, IN: Indiana University,
    1977.

-------------, <u>Eisenhower's Lieutenants</u>. Bloomington, IN: Indiana University,
    1981.

Wilcox,A.M., <u>Command, Control, and Communications</u>. McLean, VA: Brassesy's
   Defense, 1983.

Documents

Information briefing presented by BG J.H. Granrud to the 1986 AUSA Convention.
   Subject: Command, Control and Communications. DTIC Number ADB 101334.

Information briefing presented by MG G.R. Sullivan to the 1987 AUSA Convention.
   Subject: Command and Control. DTIC Number ADB 111701.

Manuals

Field Manual 100-5, <u>Operations</u>. Washington, D.C.: Department of the Army,
   1986.

Field Manual 100-6, <u>Large Unit Operations (Coodinating Draft)</u>. Ft.
   Leavenworth, KS: Command and General Staff College, 1987.

Field Circular 100-6-1, <u>Theater Army, Army Group, and Field Army Operations</u>.
   Ft. Leavenworth, KS: Combined Arms Combat Development Activity, 1984.

Field Circular 100-55, <u>Corps and Division Command and Control</u>. Ft.
   Leavenworth, KS: Command and General Staff College, 1985.

Periodicals

Babcock, J., "Tactical Communications -- The Linkage between C2 and I." <u>Signal</u>,
   <u>35</u>, (3), pp 11 - 15.

Berman, E.A., "Balancing Force and Force Structure." <u>Signal</u>, <u>42</u>, (1), pp 99 -
   101.

Dierksmeier, F.E., "The Impact of MSE." <u>Military Review</u>, <u>67</u>, (8), pp 40 - 47.

DePuy, W.E., "Toward a Balanced Doctrine." <u>Army</u>, <u>34</u>, (11), pp 18 - 25.

Harding, p., "C3I Supporting the Commander's Game Plan." <u>Signal</u>, <u>42</u>, (2), pp
   27 - 31.

Harned, G.M., "Quality versus Quantity: Limits of Operational Art." <u>Army</u>, <u>36</u>,
   (6), pp 34 - 40.

Holder, L.D., "A New Day for Operational Art." <u>Army</u>, <u>35</u>, (3), pp 22 - 32.

Kelly, M.R. & Romanelli, R.P., "Modeling a Complex C3 System." <u>Signal</u>, <u>40</u>,
   (7), pp 83 - 89.

Lind, W.S., Wilson, G.I., & Wyley, M.D., "The 'Maneuver Warfare' Concept."
   <u>Marine Corps Gazette</u>, 1981 (April), pp 49 - 54.

Luttwak, E.N., "The Operational Level of War." International Security, 5, (3), pp 61 - 79.

Newell, C.R., "Fog and Friction: Challenges to Command and Control." Military Review, 67, (8), pp 18 - 26.

Nunn, S., "Defense Organization: The Need for Change." Armed Forces International, 123, (4), pp 13 - 15.

Snyder, F.M., "Command and Control and Uncertainty." Naval War College Review, 23, (2), pp 109 - 113.

Summers, H.G. Jr., "How We Lost." The New Republic, 1985 (April 29), pp 20 - 23.

Thompson, R., Butler, K., & Thomas, J., "Falklands Islands War -- A Signaler's Viewpoint." Signal, 37, (9), pp 105 - 115.

Special Studies

Buckley, J.L., An Analysis of US Army C2 Organization in the Pacific Theater, World War II to 1983. Ft. Leavenworth, KS: Command and General Staff College, 1983.

Devers, J.L., Major Problems Confronting a Theater Commander in Combined Operations. Ft. Leavenworth, KS: Command and General Staff College, 1947.

Hughes, P.M., Battlefield Deception Primer. Ft. Leavenworth, KS: School of Advanced Military Studies, 1987.

Jensen, B.A., Corps Area Communications Support of FM 100-5 (Operations) Doctrine. Carlisle Barracks, PA: US Army War College, 1986.

Ministry of Defense, United Kingdom, Army Training Note 19, The Operational Level of Command. London: Ministry of Defense, 1987.

Schneider, J.J., The Theory of Operational Art. Ft. Leavenworth, KS: School of Advanced Military Studies, 1988.

Waldrop, G.L., The Role of Requirements Analysis in Command and Control Systems. Ft. Leavenworth, KS: Command and General Staff College, 1981.

Willbanks, J.H., AirLand Battle Tactical Command and Control: Reducing the Need to Communicate Electronically in the Command and Control of Combat Operations at the Tactical Level. Ft. Leavenworth, KS: Command and General Staff College, 1984.

Unpublished Manuscripts

Byrd, D.E., Command and Control Considerations for Field Army Operations: A Primer on Joint Operations. Ft. Leavenworth, KS: School of Advanced Military Studies, 1986.

Crenshaw, C.T. III, Distinctions between Tactical and Operational Levels of War -- Are Some more Important than Others? Ft. Leavenworth, KS: School of Advanced Military Studies, 1986.

Fincke, D.E., Principles of Military Communications for C3I. Ft. Leavenworth, KS: School of Advanced Military Studies, 1986.

Gardner, G.C., Generalship in War: The Principles of Operational Command. Ft. Leavenworth, KS: School of Advanced Military Studies, 1987.

McElwee, J.W., Principles for Organization of Joint and Combined Staffs. Ft. Leavenworth, KS: School of Advanced Military Studies, 1986.

Nelson, J.T. II, Where to go from Here? Considerations for the Formal Adoption of Auftragstaktik by the US Army. Ft. Leavenworth, KS: School of Advanced Military Studies, 1986.

Runals, S.E., Command and Control: Does Current US Army Tactical Command and Control Doctrine meet the Requirements for Today's High Intensity Battlefield? Ft. Leavenworth, KS: School of Advanced Military Studies, 1985.

Schmidt, T.C., Tactical Information Gathering in the High Technology Command and Control Environment: A Division Commander's Leadership Challenge. Ft. Leavenworth, KS: School of Advanced Military Studies, 1985.

Tuttle, H.S., The Use of Command and Control to Enhance Agility and Synchronization on the AirLand Battlefield. Ft. Leavenworth, KS: School of Advanced Military Studies, 1986.

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